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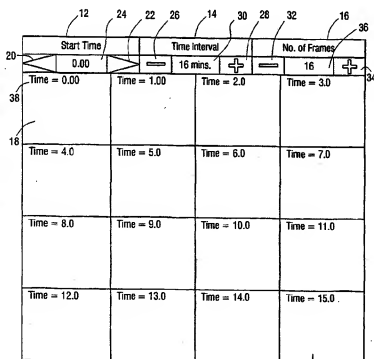
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(54) Title: FACILITATING ACCESS TO DIGITAL VIDEO



(57) Abstract: A digital video editing system uses a graphical user interface (10) which facilitates the selection of a video sequence of interest and its representation in a conveniently visualized form. Through the graphical user interface (10), the user may select a starting frame (12), a time interval (14), and a number of frames (16) within the time interval which may be represented by thumbnail depictions (18) of selected video frames. Once the video sequence is represented by a selected sequence of video frames over a selected interval, the user can then use editing techniques to manipulate the portions of the video sequence represented by the thumbnail depictions.



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Facilitating Access To Digital Video

Background

This invention relates generally to editing video stored in a digital format.

A number of formats for digital video currently exist. For example, in connection with so called broadcast pause and resume systems, a conventional hard disk drive may be utilized to store streaming television programming. These systems may alternatively read and write video from and to the same storage medium such as a hard disk drive. In addition, digital video may be stored on a digital versatile disk or other optical storage media.

Once the video has been stored in a digital format, manipulation of that video may be undertaken using processor-based systems. For example, conventional digital versatile disk players may incorporate a selective zoom function wherein the user may use a remote control to zoom a portion of the picture in a selected quadrant.

However, in most conventional digital formats, the ability to edit the stored video is relatively limited. The user can replay the information by selecting zoom features, slow motion, stills, and other techniques but the ability to manipulate the data is still relatively limited.

Thus, there is a need for more ways to manipulate digital video data stored on digital storage media.

Brief Description of the Drawings

Figure 1 is a screen display in accordance with one embodiment of the present invention;

Figure 2 is a flow chart for use in connection with the screen display shown in Figure 1;

Figure 3 is a flow chart for use in connection with the screen display shown in Figure 1; and

Figure 4 is a block diagram of hardware for implementing one embodiment of the present invention.

Detailed Description

Referring to Figure 1, a graphical user interface 10 which may be displayed on a display screen of a processor-based system is useful in editing digital video data. The display

screen may be any of a variety of video displays. For example, the screen may be a liquid crystal display on a video camera, a monitor for a computer system or a television receiver coupled to a set-top box.

The graphical user interface 10 may be utilized to selectively manipulate digital data in the form of a plurality of video frames 18. The plurality of frames 18 may be automatically displayed as a storyboard or gridwork of thumbnail displays. Thus, each frame is shown in a reduced size commonly called a "thumbnail". A video sequence to be edited may be represented by the thumbnail frames. The sequence may be selected from a longer video by choosing a start time and a time interval from the start frame. The number of thumbnail frames over the selected interval, taken at regular times, may also be selected.

The user may use an icon 12 to indicate the start time for the selection of the thumbnails 18. The time interval icon 14 may be utilized to indicate the amount of time within a longer video sequence which is of interest. The icon 16 allows the number of frames within the selected time interval, starting at the start time, to be selected by the user. For example, with the start time icon 12, an increase button interface 22 and a decrease button 20 are provided on either side of a display 24 vary the selected start time. The display 24 may indicate the selected start frame by a time indicator.

The frames of any video sequence may be enumerated using a conventional time based system such as the standard promulgated by the Society of Motion Picture and Television Engineers (White Plains, New York 10607) denominated as SMPTE 12M-1999 Television, Audio and Film-Time and Control Code. Each frame may be identified by a time in hours, minutes, seconds and thirtieths of seconds, with video having 30 frames per second. A start time may be indicated in second fractions, seconds, minutes and hours.

When the user presses the increase button interface 22, the start time, displayed on the display 24, increases. Similarly, the time interval, during which the thumbnails 18 are selected, may be controlled by an icon 28 which causes the time interval to be increased, and an icon 26 which decreases the time interval. In the illustrated embodiment, the start time is the time zero and the time interval is sixteen minutes. Thus, sixteen minutes of video are selected for producing the thumbnails. The number of frames selected within the time interval, entered through the icon 16, may be increased with the button interface 36 and decreased with the button interface 32. The number of frames are indicated in the display 34 as being sixteen in the illustrated embodiment.

Thus, as indicated below the icons 12, 14 and 16, sixteen thumbnail frames at one minute time intervals are displayed. A frame is selected at the beginning of each one minute increment. For each minute of video, using video at thirty frames per second, one thousand eight hundred frames are represented by the single starting frame illustrated as a thumbnail 18. Thus, each minute after the initial starting time of zero, a frame is selected and displayed as a thumbnail 18 until sixteen frame thumbnails 18 are displayed. Since the number of selected frames was sixteen, sixteen minutes were selected as the interval and the start time was zero, starting from the beginning of the video, sixteen thumbnail frames 18 are displayed, one for each one minute of video.

The user may increase the start time from that illustrated in Figure 1 and may increase or decrease the selected time interval and the number of frames as described previously. Thus, the user can select a given resolution in the terms of the number of frames to control the manipulation of the video sequence. The length of the video sequence in terms of the time interval may also be selected. Likewise, the location of the video sequence of interest may be controlled.

Once a representation of a given time interval of a video sequence is created, via the graphical user interface 10, the user can set about editing that video sequence. For example, sections of the time interval of video frames, displayed on the graphical user interface 10 may be eliminated by simply indicating a start and stop frame 18 for the group of frames to be eliminated. The start and stop frames and the intervening frames (between the start and stop frames) are thereby eliminated.

Similarly, different video effects may be applied selectively to a video sequence represented by the thumbnail frames 18. For example, fade ins, fade outs or other video effects may be provided. The light intensity of the various frames may be changed as well. The graphical user interface 10 provides a convenient way to manipulate a given section of video data. Through the use of the icons 12, 14 and 16, the window which defines the way the video sequence is visualized for editing purposes may be easily adjusted by the user.

The software 38 for implementing the graphical user interface 10, shown in Figure 2, begins by determining whether the graphical user interface 10 has been selected as indicated in diamond 40. If so, the flow waits for a start time selection through the icon 12. Once the start time is selected, the first frame is designated, grabbed and stored as indicated in block 44. Next, the flow waits for the time interval selection as indicated in diamond 46. Once that

selection is made, the portion of the video which is of interest is defined and the corresponding frames may be grabbed as indicated in block 48. Finally, the number of frames that are utilized to represent the video may be provided in response to a query represented by the diamond 50. Once that information is provided, the software 38 may then display the graphical user interface 10. If any of the selections are not timely made through the icons 12, 14 and 16, default values may be entered automatically.

Referring next to Figure 3, the software 60 for editing the video represented by the graphical user interface 10 may implement a frame elimination protocol in one embodiment of the present invention. Initially, the user indicates a start frame as indicated in diamond 62. Once the user indicates a start frame, that start frame identifier is stored as indicated in block 64. The identifier may include an hour, minute, second, and subsecond designation of the particular frame in the sequence. That information may be provided in a header associated with the frame. Next, the software 60 awaits the user's input of an end frame as indicated in diamond 66. Once this input is received, the end frame identifier may be stored as indicated in block 68. The intervening frames are then eliminated as indicated in block 70.

In this way, the graphical user interface 10 provides an easy way for the user to visualize a sequence of video. The software 38 creates a graphical user interface 10, including the icons 12, 14 and 16, that facilitates the manipulation of the storyboard which represents a video sequence.

Embodiments of the present invention may be used as a suppression tool, suppressing access to offensive or obscene video portions. For example, a parent may wish to prevent a child from viewing portions of a video. With the present invention, a series of frames of video may be tagged to prevent viewing under certain circumstances. For example, an access code may be required to view the tagged sequence of frames.

Another application for embodiments of the present invention is in connection with so-called broadcast pause and resume systems. These systems enable a user to store and replay video at the same time. However, the user must also navigate through the video sequences to facilitate the broadcast pause and resume features. Using embodiments of the present invention, one can readily navigate within the stored video.

A processor-based system 72, shown in Figure 4, in accordance with one embodiment of the present invention generates the graphical user interface 10 on a television display 84. The system 84 is a set-top box but the present invention is in no way limited to this

embodiment. It is applicable to a wide variety of systems which display and store digital video information including digital video cameras, desktop computers, laptop computers, portable and handheld devices, appliances, as examples.

5 The system 72 includes a processor 74 coupled to an accelerated graphics port (AGP) chipset 76 for implementing an accelerated graphics port embodiment. The chipset 76 communicates with the AGP port 80 and the graphics accelerator 82. A television 84 may be coupled to the video output of the graphics accelerator 82. The graphical user interface 10 may be displayed on the television 84. The television 84 may be coupled to the video output of the graphics accelerator 82. The chipset 76 accommodates the system memory 78.

10 The chipset 76 is also coupled to a bus 86 which may be, for example, a Peripheral Component Interconnect (PCI) bus. The PCI Local Bus Specification, Rev. 2.2 is available from the PCI Special Interest Group, Portland, Oregon 97124. The bus 86 connects to a TV tuner/capture card 88 which is coupled to an antenna 90 or other video input such as a cable input, a satellite receiver/antenna or the like. The TV tuner/capture card 88 selects a desired television channel and also performs a video capture function. One exemplary video capture card is the ISVR-III video capture card available from Intel Corporation.

15 The bus 86 is also coupled to a bridge 92 which couples a hard disk drive 94. The software 38 and 60 may be stored on the hard disk 94 together with the video sequence being manipulated. The bridge 92 is also coupled to another bus 96. The bus 96 may be coupled to a serial input/output device 98. The device 98 is in turn connected to an infrared interface 100 which interacts with a remote control unit 104 which is also infrared based. Also connected to the bus 96 is a basic input/output system (BIOS) 102.

20 While the present invention has been described with respect to a limited number of embodiments, those skilled in the art will appreciate numerous modifications and variations therefrom. It is intended that the appended claims cover all such modifications and variations as fall within the true spirit and scope of this present invention.

What is claimed is:

- 1 1. A method comprising:
2 receiving an indication of a start time for a video sequence to be edited;
3 receiving an indication of a time interval within the sequence to be edited; and
4 receiving an indication of a number of frames that are to be utilized to
5 represent the video sequence.
- 1 2. The method of claim 1 including providing a graphical user interface with
2 icons for the entry of information concerning the start time, time interval and number of
3 frames.
- 1 3. The method of claim 1 including providing a graphical user interface which
2 provides fields for entering data and displays a series of video frames in thumbnail format.
- 1 4. The method of claim 3 including providing a default value if data is not
2 received within a predetermined time period.
- 1 5. The method of claim 1 including providing a graphical user interface which
2 indicates data for a start time, a time interval and a number of frames, and providing buttons
3 to increase or decrease the data.
- 1 6. The method of claim 1 including receiving edit commands using thumbnail
2 depictions of representative frames.
- 1 7. The method of claim 1 including representing a video sequence as a number of
2 thumbnail depictions of exemplary frames within said sequence, said frames beginning at the
3 entered start time.
- 1 8. The method of claim 6 including enabling the number of depictions to be
2 selected by the user.

1 9. An article comprising a medium for storing instructions that cause a
2 processor-based system to:
3 receive an indication of a start time for a video sequence to be edited;
4 receive an indication of a time interval within the sequence to be edited; and
5 receive an indication of a number of frames that are to be utilized to represent
6 the video sequence.

1 10. The article of claim 9 further storing instructions that cause a processor-based
2 system to provide a graphical user interface with icons for the entry of information
3 concerning the start time, time interval, and number of frames.

1 11. The article of claim 10 further storing instructions that cause a processor-
2 based system to provide a default value if data is not received within a predetermined time.

1 12. The article of claim 10 further storing instructions that cause a processor-
2 based system to provide a graphical user interface which provides fields for entering data and
3 displays a series of video frames in thumbnail format.

1 13. The article of claim 10 further storing instructions that cause a processor-
2 based system to provide a graphical user interface which indicates data for a start time, a time
3 interval, and a number of frames, and provides buttons to increase or decrease the data.

1 14. The article of claim 10 further storing instructions that cause a processor-
2 based system to receive edit commands using thumbnail depictions of representative frames.

1 15. The article of claim 10 further storing instructions that cause a processor-
2 based system to represent a video sequence as a number thumbnail depictions of exemplary
3 frames within said sequence, said frames beginning at the entered start time.

1 16. The article of claim 15 further storing instructions that cause a processor-
2 based system to enable the number of depictions to be selected by the user.

1 17. A system comprising:
2 a processor;
3 a storage coupled to said processor, said storage storing software that creates a
4 graphical user interface that receives an indication of a start time of a video sequence to be
5 edited, an indication of a time interval within the sequence to be edited, and a number of
6 frames that are to be utilized to represent the video sequence.

1 18. The system of claim 17 wherein said system includes a display coupled to said
2 processor.

1 19. The system of claim 17 wherein said graphical user interface displays a video
2 sequence as a series of thumbnail frame depictions.

1 20. The system of claim 19 wherein the user can manipulate said frames as
2 thumbnail frame depictions.

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	12	24	22	26	14	30	28	32	16	36
20	Start Time			Time Interval				No. of Frames		
	0.00		16 mins.	+	16	+				
38	Time = 0.00		Time = 1.00		Time = 2.0		Time = 3.0			
18	Time = 4.0		Time = 5.0		Time = 6.0		Time = 7.0			
	Time = 8.0		Time = 9.0		Time = 10.0		Time = 11.0			
	Time = 12.0		Time = 13.0		Time = 14.0		Time = 15.0			

FIG. 1

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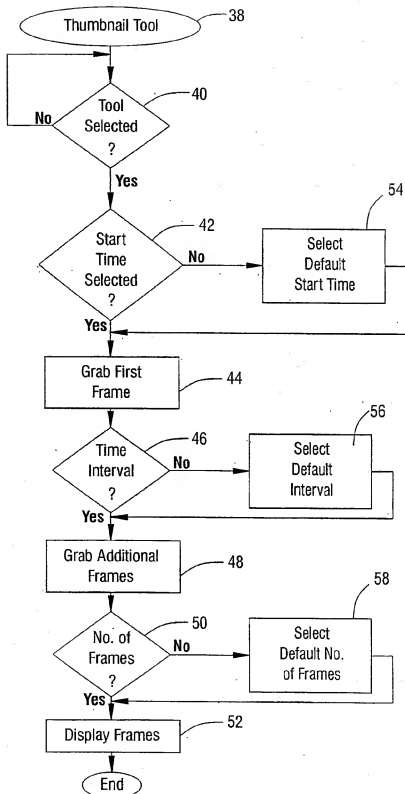


FIG. 2

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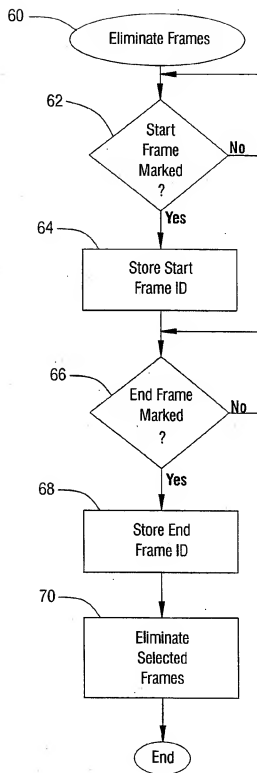


FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 01/02771

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G11B27/034 G06F3/033 G06F9/44 G11B27/34

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G11B G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 760 767 A (BARDINI RICHARD A ET AL) 2 June 1998 (1998-06-02) the whole document	1-20
A	EP 0 920 014 A (SONY CORP) 2 June 1999 (1999-06-02) column 7, paragraph 31 - paragraph 34 column 30, paragraph 136 - column 39, line 196	1-3, 5-10, 12-20
A	EP 0 915 471 A (HITACHI LTD) 12 May 1999 (1999-05-12) the whole document	1-3, 5-10, 12-20

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5760767 A	02-06-1998	NONE	
EP 0920014 A	02-06-1999	WO 9847146 A	22-10-1998
EP 0915471 A	12-05-1999	JP 11146325 A	28-05-1999

Form PCT/ISA/210 (patent family annex) (July 1992)